The Northern Sea Route: Long-Term Impact on the Economic Development

Yuliya V. PANKOVA

Engineer

Institute of Economics and Industrial Engineering of the Siberian Branch of the Russian Academy
of Sciences

17 Ac. Lavrentieva Ave., Novosibirsk, 630090, Russia

yu.v.pankova@mail.ru

Grant details: RFBR-RGS no. 17-05-41018 on Complex Assessment of Variants of Establishing the
Core Transportation Network of the Asian part of Russia: Resource and Socio-Economic
Opportunities

Abstract

The purpose of research is to carry out quantitative estimation of the effects of intensification in cargo shipping along the Northern Sea Route (NSR) in consideration of various plausible perspectives for its viability. Using an multiregional input-output model, the country's economic development forecasts until 2030 are made through in three scenarios. Pursuant to the results of comparative analysis of their indicators, a negative economic impact is highly likely if using the NSR solely as a transit route for foreign vessels. In case in the Arctic zone of the Russian Federation the implementation of infrastructural and resource projects takes place to enable export deliveries along the NSR, the prospects for 2030 are positive, and shall remain as such even when the unfavorable economic trends are modelled. Nonetheless, the realization of such a scenario leads towards an escalation in raw-material export orientation of the economy.

Keywords: the Northern Sea Route; the Arctic; forecast; cargo shipping; multiregional input–output model.

Introduction

Over the recent years, the Arctic and the Arctic Ocean have become the subject of international debates with increasing frequency, and being talked over in the context of economics and geopolitics. This interest is also growing by the climate change that may in its turn result in changes in thickness of the ice cover in the Arctic seas. The latter shall impact, among other aspects, the use intensity of routes along the Northern Sea Route (NSR).

Currently, ambiguity of the research forecasts can be discussed as regards the prospects of ice melting near the North Pole. For example, in (Wang, Overland, 2009), on the grounds of the climate models, the ice clearance in the Arctic is predicted in 30–40 years. In addition, in (Comiso, 2012) it is proved that the perennial ice is shrinking at a faster rate than the younger and thinner one. In light of this, by the year of 2050, an extension of up to 120 days or longer is expected for the period when the NSR is clear of the ice (Byers, 2009). Nowadays still, the navigation along the NSR is associated with the need to use ice-class vessels, and involve icebreaker assistance (the navigation without them is possible during only 3 to 4 months per year), meaning the extra costs for escorting and navigating vessels.

Although at this stage, the NSR is not regarded for the purposes of global logistics as the primary transit route for the foreign vessels from Europe to Asia, the growth potential for the NSR in this

regard owing to the aforementioned climatic change cannot be discarded. Thus, in the future, the commercial use of the NSR can become more profitable and energy efficient if compared to the other international transit corridors as it is discussed in some papers (i.e., Lasserre (2014), Theocharis et al. (2018), Wang, Zhang, and Meng (2018)). Additionally, skimming on the fuel costs when using the NSR during the summertime navigation is already significant, 3-5% i.e. the container carriers (10 000 TEU) moving from Northwest Europe to East Asia (Xu et al., 2011).

As a result, the growing embrace of the NSR as an alternative transit corridor for shipping between Europe and East Asia does increase, as it is evidenced by, for example, the surge in number of the transit sailings from 2010 to 2013. The subsequent recession occurred for a number of reasons, which are likely more of the geopolitical nature, and is also associated with fluctuations of the oil prices, ice situation, etc. (Milalovic et al., 2018). In the future, the growth in transit sailings along the NSR from 2–3 to 9 – 12 million tons per year is envisioned (i.e., Arctic and Antarctic Council under the Federation Council of the Russian Federation (2015), Kiiski et al. (2018)).

If the domestic cargo shipping along the NSR comes in focus, its increase as of the year of 2010 is subject to the shift in non-renewal exploitation sectors to the north, as well as advancing in the extraction volumes and export of raw materials. In fact, the large-scale capital projects associated with the natural resources mining and their subsequent export have accelerated this increase.

One of the recent high-profile events related to the NSR is enacting of the decree of the President dd. May 05, 2018 no. 204 On national goals and strategic objectives for the Russian Federation development for the Period until 2024, wherein the growth in cargo shipping along the NSR up to 80 million tons by 2024 is indicated being almost fourfold if compared to 2018. This indicator has been the subject of criticism and debates in part of the chances to achieve it by the stated period. Currently, there is no consensus among the ministries, companies, analysts and researchers as regards the potential transportation range along the NSR for the raw materials mined in the Arctic zone of Russia for the time period of up to 2025 and beyond. The values vary widely from less than 45 to more than 90 million tons (i.e., Grigoriev (2018), Komkov et al. (2016)); still all available estimates tend to revolve around one conclusion: the bulk of cargo traffic shall be comprised of hydrocarbons.

However, regardless of the specific values in cargo turnover, it is obvious that by 2025 the intensification of cargo shipping along the NSR shall impact the economic development of the country in overall and the Russian Arctic zone regions in particular. Moreover, currently, those the economies of those regions are defined by low efficiency, and the related increase requires establishing ties with the economies of the Urals and Siberia. This could boost the multiplier effects. However, the recent years are characterized by the tendency of the increasing autonomy of the projects implemented in the Arctic zone of the Russian Federation from the expansion of economic centers outside the Arctic, which is also justified by remote positioning of the territories. At the same time, the economic activity of the Arctic regions contributes highly to the social and economic development of the country: it contributes to more than 11% of the country's GDP and ensures about a 1/4 of exports.

The growth in cargo transit along the NSR shall result in imminent implementation of the set of raw materials and infrastructure capital projects in the Arctic zone of the Russian Federation. The impact of the latter on the economic growth has been repeatedly discussed and mentioned in various studies (i.e., Agenor (2010), Carlsson, Otto, and Hall (2013)). At the same time, there exists no estimation of the impact from such expansion in the context of the NSR development, and that predetermines the relevance and novelty of this research.

Consequently, the purpose of research was to carry out quantitative estimation of the effects of intensification in cargo shipping along the Northern Sea Route at the national economic level in

consideration of various plausible perspectives for the NSR viability. To achieve the purpose as stipulated, the following tasks were resolved:

1. Selected were the promising raw materials and infrastructure projects in the Arctic zone of the Russian Federation, owing to which, in the long term, escalation of the cargo shipping would be achieved;
2. Elaborated were the scenarios for the NSR development with their further revision in the context of the national economic model;
3. Performed was the analysis of the forecast scenario calculations results, with the highlights of the key positive and negative effects.

Methods

As stated above, expansion of the cargo shipping along the NSR shall result in implementation of the number of capital projects in the Arctic regions. Each of these projects shall produce certain effects normally divided into direct and indirect ones. It should be noted, that the direct effects from the investment projects implementation are assessed at the stage of feasibility study by calculating commercial efficiency indicators. These include indicators based on discounted estimates (net present value (NPV), profitability index (PI), internal rate of return (IRR), modified internal rate of return (MIRR), discounted payback period (DPP), and those based on accounting estimates (payback period (PP), average rate of return (ARR)).

Indirect effects, in fact, are reflected through the increase in indicators of the social and economic development of particular regions and the country as a whole, since the large-scale capital projects can impact the sectoral structure of the economy, production relations, price levels, etc. It needs to be specified, that the accelerated development of exploitation and transport sectors influences the regional economy in the area of which the projects are implemented, as well as other constituents with the close economic ties to the former. In addition, the large-scale projects possess an integrated inter-sectoral quality involving the related industries to ensure their commercialization. In other words, the demand for goods and services of the related industries within the target and involved regions is on the increase. As a result, the assessment of indirect effects requires the appliance of specific tools. In particular, for the purposes as such, the Institute of Economics and Industrial Engineering of the Siberian Branch of the Russian Academy of Sciences applies various settings of the optimization interindustry interregional model (OIIM). By means of OIIM, the final consumption for the year under planning is estimated as regards the project impact on the economy as a whole and the economy without the project (Malov, Melentiev, & Aleshina, 2009). After that, the obtained values are compared: a higher level of the final consumption in the economy with the project indicates a positive effect. This research was carried out pursuant to the same approach.

The specifics of multiregional models lies in the presence of chains that describe inter-regional product supply, as well as the conditions for the regional economies development. This requires the tools per se to be more sophisticated in terms of recording the dynamics and the required degree of specification for the information support. However, it is unavoidable due to the vast territory of Russia and differences between the constituents within the country. At that, the comprehensive nature of calculations consists in the fact that the regional enterprises are examined altogether, which, as a result, guarantees obtaining the outcome of development forecasts for the regions with mutually balanced external ties, and that is compulsory in the context of this research.

Among multiple settings of the dynamic models with discrete time display, the popular approach is to assess the dynamics sequentially, year after year within the selected timeframe. In this case, each step corresponds to the solution of a static optimization problem for one year, whilst the transition between the years is programmed. In this paper, the OIIM of this type was used (Melentyev, Ershov, & Alimpieva, 2010). It reflects 53 industries and 8 federal districts with the detailed

information on the Siberian Federal District by entities. All criteria and indicators are calculated at price values of 2010.

The base year in the model setting used in the paper is 2010. Further, on, the forecast is proposed envisioning the multiregional development for every final year of the forthcoming five-year plans till the year of 2030 inclusive. The model underwent adjustments as per the statistical indicators of the national accounts for 2015 (with an error level at 1%). For these reasons, a series of experimental calculations was completed, and based on the obtained results a reference economic development scenario for the country was concluded.

Data

In order to proceed with the OIIM calculations, the data required for modeling were gathered. Consequently, in the context of the model indicators system (output volume, investments needed, etc.) at prices of 2010, the data were collected as regards two types of the investment projects: the resource-based ones that would contribute to the intensification of cargo shipping along the NSR, and the infrastructure projects necessary to boost the port capacity.

The data were sourced from the national statistics, program documents of the executive authorities of the RF constituents, and scientific papers on matters discussing the Arctic and the Northern Sea Route development. In some cases, due to the impossibility to access the design details and feasibility studies, the data from open sources were taken into account, including those released by the executive management of companies.

In more detail, at the first stage of the research the current state of the maritime infrastructure of the Arctic zone of the Russian Federation underwent the analysis. Its results revealed that the implementation of the new resource-based projects is impossible without renovation and expansion of the port facilities. In addition, the requirements for the entire system of maritime transport lines in the Arctic are accentuated by the heightened attention from properly the Arctic and third countries. Certain concerns are also caused by the safety of navigation along the NSR routes: the search and rescue service bases are considerably distanced from each other, and this intercepts a timely response in event of incidents; additionally, provision of medical support in accordance with the international requirements is exclusively available at military bases. Still primarily, the expansion of nuclear-powered icebreaking fleet is required due to the fact that at least three new icebreakers are needed to use the NSR throughout the year by 2027. Among them, there are two multipurpose nuclear-powered icebreakers under Project 22220 being built by Rosatom State Corporation in St. Petersburg, as well as one icebreaker under Project 10510, the construction of which may begin in Primorsky Krai in 2020.

In total, there were identified 10 promising projects planned for implementation and needed for development of the port infrastructure and loading and unloading complex, in addition to the stated auxiliary icebreaking fleet.

Listed below are the cargo shipping trends and potential transportation capacity as regards the raw materials exploited in the Russian Arctic in view of the NSR. Further, the promising corridor development options are identified. As a result, presented is a selection of the potential resource-based capital projects (12 projects in total), and hypotheses as regards the future development of the Russian Arctic is reflected in the scenarios as follows.

The 'no-change' scenario for the development of the economy assumes preservation of the existing trends in economic development of the country. At that, this scenario does not presupposes the escalation of cargo shipping along the NSR, and, thus, no implementation of all the investment projects mentioned above. This scenario is needed for the purposes of direct matching of the forecast quantitative indicators with those of other scenarios and, in this sense, represents the starting point for evaluation of the effects.

The 'transit' scenario assumes an increase in container transportation along the NSR up to 5 million tons in view of its potential commercial profitability and existing forecasts as mentioned earlier. At that, a through transit is implied, i.e. the vessels in transit do not call at ports within the aquatic zone the Russian Federation but pass it by. As a result, the auxiliary construction and renovation of the maritime transport infrastructure is not required for the maintenance of vessels. However, the growth of icebreaker fleet is necessary for pilotage of the vessels. For this reason, the scenario envisions the construction of the three mentioned above new icebreakers. The total amount of required investments, in our estimation, amounts to 269 billion rubles. The increase in international transit shipping is modeled by expanding the export of maritime transport services and is evaluated as per the fees charged for icebreaking assistance with reliance on the approved fare.

The 'export' scenario, in addition to international transit, also represents the implementation of 12 projects in line with the development of mining industry (projects run by PJSC NOVATEK, MC VostokUgol, PJSC MMC Norilsk Nickel, etc.) and 10 projects in line with the development of port infrastructure (terminals Tanalau, Chaika, Utrenniy, etc.) in the Arctic zone of the Russian Federation. The selection of these projects was referred heretofore. The total amount of investments exceeds 2 655 billion rubles. In this scenario, the export of minerals mined in the Arctic zone of the Russian Federation increases by more than 84 million tons, and their production is assisted by the maritime vessels.

Subsequently, a sustainability analysis of the 'export' scenario effects was carried out by simulating an unfavorable economic situation. In other words, simulated were difference in price level for raw materials in the global market, under sanctions, geopolitical pressure, etc., namely the reduction in supply volume of the already extracted resources available in the foreign market, or their trading at lower external prices. It was assumed, that as a result of such external influence, only a $\frac{1}{4}$ of the total volume of raw materials exploited in the Arctic zone of the Russian Federation can be exported. Besides, since the used model setting assumes the balanced export-import operations, the volume of import supply is reduced accordingly. This scenario is needed to a greater extent in order to identify areas of the necessary changes in the sectoral structure of the economy to adapt to the slowdown in external environment.

Further, employing OIIM for each of the scenarios, the spatial forecast was made for the time period until 2030. Obtained were the estimated values of the target function (final consumption) and other macroeconomic indicators revealing the economic development for the planning period. The analysis of the dynamics of change within each scenario on a yearly basis and between the scenarios at the same period allows for drawing meaningful conclusions as regards the structural changes in the economy of the country and individual regions.

Results and Discussion

With the reference to the calculations outcome, it was noted that when implementing the 'transit' scenario, the final consumption by 2030 stays at 7 billion rubles lower than when implementing the 'no-change scenario'. The prospective consumption shrinks due to the net outflow from the consumer complex as the icebreakers are being built. In other words, the machine-building sector functions in a less direct way to satisfy the immediate needs of population, but rather creates the conditions for the development of the Northern Sea Route at the international level. At the same time, it is required to account for the fact that the obtained estimate of the effect stands at just - 0.02%. Even smaller difference is recorded for the gross output.

Comparison of the results for the 'export' and 'transit' scenarios for 2030 leads to the conclusion on positive effect of the cargo shipping expansion along the NSR owing to the implementation of a range of investment projects and an increase in raw materials exploitation volumes with their subsequent export. In particular, the final consumption in the 'export' scenario is 8.31% higher.

However, the crucial advantage of the presented approach is not just its ability to quantify the effects, but also the ability to analyze the structural changes in the economy. Besides, the multiregional model setting allows for tracking shifts at federal district levels as well as individual entities in Siberia. Thus, for instance, the absence of significant changes in multiregional supplies, as per the results of the 'transit' and 'export' scenarios, indicates that the ties of the actively developing Arctic regions with the southern ones does not get tighter. Hence, the impact from the investment projects is localized in the regional areas of their implementation.

Another conclusion made on the grounds of the compared forecast indicators of the scenarios lies in strengthening of the export-raw model of the country's economy in the 'export' scenario. Mineral resources are exported without creating additional value within the country, and their share in exports is increasing. It should also be noted that the growth of raw material production in the Arctic zone regions of the Russian Federation in some cases (for instance, in the Far Eastern Federal District) is accompanied by the decline in growth rate of consumer goods production sectors and growing imports in those sectors.

Additional analysis of sustainability of the effects in the context of the 'export' scenario shows that with a 70% reduction in the export of raw materials exploited in the Arctic zone of the Russian Federation, the positive national economic effect persists. At the same time, the change in final consumption does not exceed 0.35% while maintaining the balance of export-import operations. If the changes at the sectoral structure level are discussed, then the consumer goods production sectors (for instance, food and textile production) are developing more rapidly with their imports reduced. In other words, the identified changes reflect import substitution. At the same time, the slower growth rates are typical for the sectors of mineral resource exploitation except for those regions and sectors for which the implementation of investment projects is envisioned by the 'export' scenario.

Conclusion

In the framework of this research, the negative macroeconomic effect was obtained when using the NSR only as a transit route for foreign vessels. If in the Arctic zone of the Russian Federation the implementation of infrastructure and resource projects is carried out, allowing for use of the NSR for export deliveries, then the effect for 2030 is considered positive. This is reflected in a faster growth in final consumption. At the same time, the implementation of such a scenario leads to the growth in the export-raw material model of the economy. The obtained positive economic effect is maintained in event of deteriorating economic situation. Moreover, the sustainability analysis revealed the effective ways to adapt to the adverse external changes in terms of shifts in the sectoral structure of the economy. Since the forecasts obtained by OIIM are balanced by the regional and sectoral plans for economic development, the guidelines for the achievement of which are not given in the model, these results can be used if necessary to 'smooth out' the negative effects from the slowdown in external environment.

Further evolution of the research presupposes evaluation of the scenario in which some share of the raw materials exploited in the Arctic zone of the Russian Federation is processed inland into the goods of higher added value.

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